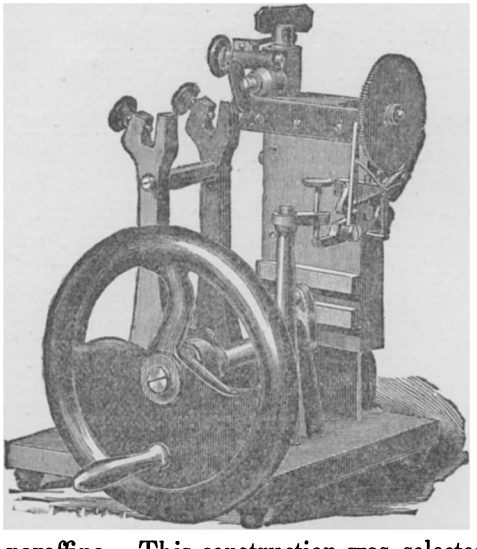
MICROSCOPY.[1]

MINOT'S AUTOMATIC MICROTOME.—The principle of this Microtome is to obtain sections by moving the object to be cut in a vertical plane past the knife which is held in a fixed position. The knife is clamped by two screws in jaws at the top of two upright pillars to be seen in the figure. The object to be cut is imbedded in paraffine and stuck on to a circular brass plate which faces the knife, when the plate is in position. This plate has the motion in three directions, and may be revolved around its own centre, so that the position of the object may be adjusted as desired. The well-known construction, used on the Schanze Machines, has been adopted to secure the necessary play of movement for the plate,



carrying the paraffine. This construction was selected on account of its simplicity and convenience, and the great firmness with which the plate may be clamped. The object holder rests on a horizontal plate which may be fed towards the knife by a micrometer screw, the head of which is a toothed wheel. *Each tooth equals* $\frac{1}{300}$ *mm. forward movement.* The whole of this complete object-carrier is fastened to an upright slide. The slide is worked up and down by a crank, as seen in the cut, and the crank is moved by turning a heavy iron wheel.

[1] Edited by C. O. Whitman, Director of the Lake Laboratory, Milwaukee, Wis.

When the wheel is revolved, the crank is turned, and the upright slide rises and falls in a vertical plane, and of course the object-carrier, with its micrometer screw, rises and falls with it. As the carrier rises a lever connected with a pawl strikes against a screw on a separate pillar; the pawl catches in the toothed wheel-head of the micrometer screw and so turns it, and moves the paraffine towards the knife. As the carrier descends a section is cut off, when it is near the top of its upward excursion, the micrometer screw is turned by the pawl, and the next descent produces another section. By simply turning the screw against which the pawl lever strikes, the number of teeth caught by the pawl, and therefore the thickness of the sections may be varied from 1-300 to 1.33 of a millimeter.

This microtome has been devised to avoid the obvious inconveniences attaching to the rocking and other automatic microtomes.

Since the first lot of these microtomes were placed in the market, some important improvements have been made, among which may be mentioned the strengthening of the upright slide in which the carrier moves. This improvement secures regularity and precision in the movement of the object, and renders the microtome one of the best for paraffine-cutting now in the market. This microtome, with one knife in case, is supplied by the Educational Supply Company, 6 Hamilton Place, Boston.

THE EYES OF SCORPIONS.[1]—In the median eyes, by careful dissection, the soft part may be separated from the lens and cuticula, and cut without the interference of these hard structures. The separation is best accomplished after the tissues have been hardened. This method of dissection cannot be applied to the lateral eyes, for they are almost completely surrounded by chitine. In these eyes the best results were obtained by trimming off the chitine around the eyes, and cutting the retina and the lens after the removal of as much chitine as possible.

The pigment is so abundant and so dense that even the thinnest sections cannot be studied to advantage until they have been depigmented. For this purpose I know of only two classes of successful reagents, acids and strong alkalis. Grenacher has generally employed the first, Graber the second.

Of the acid reagents strong solutions are required. Lankester and Bourne employed 5 or 10 per cent. solutions of nitric acid. In the eyes which I have studied, this mixture did not remove the pigment, even after the lapse of a week; and I was forced to use stronger and stronger grades, till 50 per cent. was reached. This mixture gives fair results, but must be made and used with caution. *A given volume of acid should be poured slowly into an*

[1] G. H. Parker, "The Eyes in Scorpions." Bull. Mus. Comp. Zool., vol. xiii., No. 6, pp. 174-177. Dec., 1887.

equal measure of alcohol, never the reverse, and the mixture should be kept cool, otherwise the acid may attack the alcohol. In such an event the solution is rendered worthless, and, should the specimens be in it at the time, the heat generated by the reaction gives the acid such additional dissolving power that the sections are at once destroyed. A more efficient acid reagent is a mixture of equal parts hydrochloric and nitric acids. A 35 per cent. solution of this mixture in strong alcohol gives better results than the pure nitric acid at 50 per cent., and does not so readily attack the alcohol.

Of the alkalis, weak ammonia, sodic hydrate, and potassic hydrate are most serviceable. The solids are to be preferred to the ammonia, since from them solutions of a definite strength can more easily be made. An aqueous solution of $\frac{1}{3}$ or $\frac{1}{4}$ per cent. potassic hydrate has given the most satisfactory results.

The method of using the depigmenting fluid is as follows. Unstained material is cut in paraffine; the ribbons are mounted on a slide with Schällibaum's fixative; when the sections are fixed, the paraffine is removed with turpentine; the slide with the sections is then successively washed with alcohol of 98 per cent., 90 per cent., 70 per cent., and so on, till a grade homogeneous with the depigmenting fluid is reached. Into a shallow white dish filled with the depigmenting fluid the slide is now gently lowered. In a *few seconds* the pigment, dissolving, will be seen as a reddish cloud. The process is usually completed in less than a minute, and the slide is promptly transferred to a dish of clean water or alcohol and there gently rinsed. The sections are next stained by exposure to the dye in a shallow dish. After being sufficiently stained, they may be washed and mounted in glycerine, or, after the proper steps in dehydrating and clarifying, mounted in benzol-balsam or other mounting medium.

The dyes which have been found the most serviceable are some of the carmines and hæmatoxylin. The aniline dyes have almost invariably given poor results. For general purposes Grenacher's alcoholic borax-carmine is excellent. In both embryonic and adult material Czoker's alum-cochineal gave fine nuclear outlines. In the adult eyes, the rhabdomes and the cell boundaries were most distinctly shown by Kleinenberg's hæmatoxylin. A very faint coloration with this dye gave the best results for nerve-fibres.

For the isolation of the retinal elements two maceration fluids were used. A weak solution of chromic acid, as employed by Patten, gave good results; but since the mycelium of a fungus is often developed in very dilute solutions of this reagent, it can be used only when it is carefully watched and its results are controlled by another method. It was employed in the following manner. The retina, after the removal of the lens and surrounding tissue, was placed for five or ten minutes in a $\frac{1}{5}$ per cent. solution. After this treatment,

which slightly hardened the tissues, the first solution was replaced by a second of $\frac{1}{50}$ per cent. In this the retina remained for three or four days, at the end of which time the retinal cells were easily separable. The most satisfactory method of isolating the cells is to place on a slide in dilute glycerine a small portion of the macerated retina, and, having protected it with a cover-glass raised on wax feet, to gently tap the cover-glass till the cells are separated. One part of 0.2 per cent. solution of acetic acid in sea-water mixed with an equal volume of 0.04 per cent. osmic acid in sea-water, although only partially successful as a maceration fluid for the retina in scorpions, is a reliable check for the results obtained from chromic acid.

After the cells have been isolated, the abundance of pigment which they contain so obscures their contents that scarcely more than their outlines can be studied. The removal of the pigment is on the whole more successfully accomplished before than after isolation. For this process, as for simple isolation, the retina should be subjected to the action of $\frac{1}{6}$ per cent. chromic acid for five or ten minutes, and then transferred to a solution of $\frac{1}{3}$ per cent. potassic hydrate. In this the pigment dissolves, forming a reddish cloud. After about a minute the retina should be removed to distilled water, rinsed, and transferred to Grenacher's alcoholic borax-carmine. This reagent performs both the office of a maceration fluid and a dye. In from twelve to twenty-four hours the retinal cells can be isolated, and present in different regions of the retina three principal conditions. First, those from the exterior of the retina are seriously altered by the continued action of the potash; second, those from the centre of the retina remain almost unchanged, still retaining most of their pigment; third, those from an intermediate position, without being otherwise much altered, lose most of their pigment. It is from these last that the best results were obtained.